

CHAPTER 6. PREFORMED TAPES

INTRODUCTION

Hot-applied thermoplastic materials require a high temperature to achieve a molten state for application. This requires expensive installation equipment and experienced operators. However, cold-applied plastic marking material requires neither of these things, requires no hardening time, and, under certain circumstances, exhibits a high-level of durability.

Cold-applied plastic pavement marking tapes are supplied in continuous rolls of various lengths and widths. These preformed tapes can be supplied in yellow or white, and in precut shapes to form standard lengths and symbols. Cold-applied plastic is also supplied in sheets from which special shapes, forms, or letters can be customized.

USES

Preformed tapes are most frequently used for crosswalks, stop bars, words and symbols, and other specialized treatments. Some local agencies have also indicated a preference for preformed tapes as center-lines and lanelines in areas of low traffic density. As with the hot-applied thermoplastic, cold-applied preformed tapes are reported to perform better on bituminous asphalt surfaces than on Portland cement concrete.

Properties of Cold-Applied Plastic

Preformed plastic tapes are generally recognized for their durability, especially abrasion resistance. They are ideal for sites

that involve small quantities of marking materials, particularly under severe conditions requiring frequent replacement. The ease of installation and repair for preformed tapes, which requires no equipment, makes them nearly as inexpensive for these applications as other materials. This is because the costs for other materials often includes the operation or rental cost of large-scale application equipment, which is difficult to use for small installations, particularly transverse and special markings.⁽⁶⁰⁾

Preformed tapes are nearly always fabricated as roll or sheet stock in a factory. These marking tapes consist of the same materials as are in thermoplastic markings: resin binder, pigment, glass beads, and fillers. The tapes differ in composition in that they are often backed with an adhesive for pavement bond. A surface coat of glass beads is often included for retroreflectivity.

While preformed tapes have been cited by some highway agencies as having very good abrasion resistance, other agencies complain that preformed tapes distort in areas with heavy turning movements.⁽⁵⁴⁾ Preformed tapes must be applied in areas where a good bond can be ensured. Application procedures must be strictly followed. Clean pavements are more important for preformed tapes than for any other material.

See the subsection on durability in the performance section in this chapter for a more thorough discussion of the conditions under which tapes will bond well. These are the conditions where the tapes' durability may make them cost-effective.

Cost Considerations

Preformed tapes cost more per linear foot than any other marking material. Contract prices for installation in New York in 1984 were found to be about \$1.25 per foot (\$4.10 per meter).⁽⁶⁰⁾ This compares unfavorably with \$0.04 per foot (\$0.013 per meter) for paint. Thermoplastic is only about \$0.32 per foot (\$1.05 per meter).

A comparison of expected costs and service lives should always be performed before specifying the use of preformed tapes. The tapes must be useful over their long service lives to justify their initial high cost.

Illuminated Streets

Preformed tapes often do not provide adequate retroreflectivity throughout their whole service lives. This fact, along with the material's very high cost, has limited tape use to installations such as urban intersections and urban markings. These areas, where installation of small quantities of markings is needed, are cost-effective. Tapes used in these areas have good durability, and urban markings are generally on well-illuminated streets. Installation of tapes is much simpler for these applications. Many standard marking materials require large, difficult-to-handle equipment for the same purpose.

TYPES

Preformed tapes are generally classified by expected service life and by material composition. Only two classifications of service life are distinguished: permanent and temporary. The major difference in these two types of preformed tapes is their thickness and method of adhesion to the pavement.

Permanent

Permanent preformed tapes are any inlaid installation, or a thick overlaid installation that has achieved good bond

with the surface. All preformed tapes whose manufacturers report lifetimes of more than one year are considered permanent pavement marking tapes. Two types of plastic are used in the majority of formulations of permanent tapes, urethane and pliant polymers.

Urethane

The first preformed tape material, urethane, is an extruded cold flow plastic with embedded glass beads, with or without a top surface coat of glass beads. It generally has a thickness of 60 or 90 mil (1.5 or 2.3 millimeter). It is precoated with pressure-sensitive adhesive for self-bonding and/or supplied with a separate adhesive.

Pliant Polymer

The second cold-applied plastic material is a polymer material that is somewhat more pliant than the cold extruded type. A top dressing of beads is recommended for areas where immediate retroreflectivity is required. Standard thickness of these films is 30 or 60 mil (0.76 or 1.5 millimeter). Pliant polymer tapes are precoated with pressure-sensitive adhesive for self-bonding or applied with a contact cement.

Temporary

Temporary preformed tapes are normally used in overlay installations. The inlay and overlay installation techniques are discussed under Installation and Removal. They are thinner than the permanent tapes, are foil-backed, with a precoating of adhesive for self-bonding.

Temporary preformed plastic tape is used often for temporary markings in construction work zones. The advantage of this material is its easy removability. It can be removed intact (or in large pieces) from either asphaltic concrete (AC) or Portland cement concrete (PCC) pavements. Removal can be manual or with a roll-up

device without the use of heat, solvents, grinding, or sandblasting.

The material consists of a single layer of pigmented binder and glass beads applied to a backing layer of metal foil.⁽⁶⁰⁾ These foil-backed tapes range from temporary tapes with high initial brightness but low durability to tapes offering several years of service. In addition to the adhesive applied to the tape in the factory, a primer may be recommended in some cases to enhance pavement bond.

PERFORMANCE

Like any other pavement marking material, preformed tapes' performance is judged in terms of their visibility and durability. Some basic characteristics of tapes' performance in these two areas are discussed in following two sections. In particular, discussion concerns preformed tapes' particular problems concerning long-life retention of sufficient glass beads for good retroreflectivity.

Retroreflectivity

One of the main reasons that preformed tapes, though highly durable, have not been cost-effective is their lack of good retroreflectivity throughout their service lives. Most tapes are so lacking in adequate night visibility that many State highway agencies specify their use only on well-illuminated roadways. This significantly restricts their use.

Some highway agencies have searched without success for a tape that provides adequate retroreflectivity.^(61,62) Some promise has been shown by tapes employing 1.75 RI (refractive index) beads, but the tape itself still outlasted its retroreflectivity. In most cases, the tape's initial good retroreflectivity retained for some time, but eventually it deteriorates to an unacceptable level due to insufficient matrix beads.

Durability

A 1983 study by the New York State Department of Transportation (NYSDOT) attempted to identify the surfaces upon which preformed tapes performed well.⁽⁶¹⁾ Their experience resulted in several observations. Inlaid markings outperform overlaid markings if a good bond is achieved with the pavement. (See the Installation and Removal section of this chapter.) Tapes must be installed quickly on inlaid installations to achieve good bond with the pavement (that is, while pavement is still warm). Tire traffic over the markings clearly helps ensure good bond with the pavement. Adhesion failures are more likely to occur in areas receiving little traffic. Tapes should not be installed on fine-textured PCC pavements, as this will cause delamination failure between the tape and its adhesive backing. Finally, both abrasion and adhesion failures are accelerated if the tape is installed over asphaltic concrete in a deteriorated condition.

INSTALLATION AND REMOVAL

The value of preformed tapes is their extraordinarily simple installation and removal procedures. Special or complex equipment is usually not required for installation. Sometimes a rolling applicator device is used for longitudinal marking applications. A paving roller often is employed to ensure even contact with the pavement, thus ensuring good adhesion. Crosswalk and stop bar applications normally do not even require this equipment.

Installation

Preformed tapes can be installed by the inlay method or the overlay method (figure 36) depending on type and condition of the pavement. With either of these methods, the markings are ready to receive traffic immediately after installation.

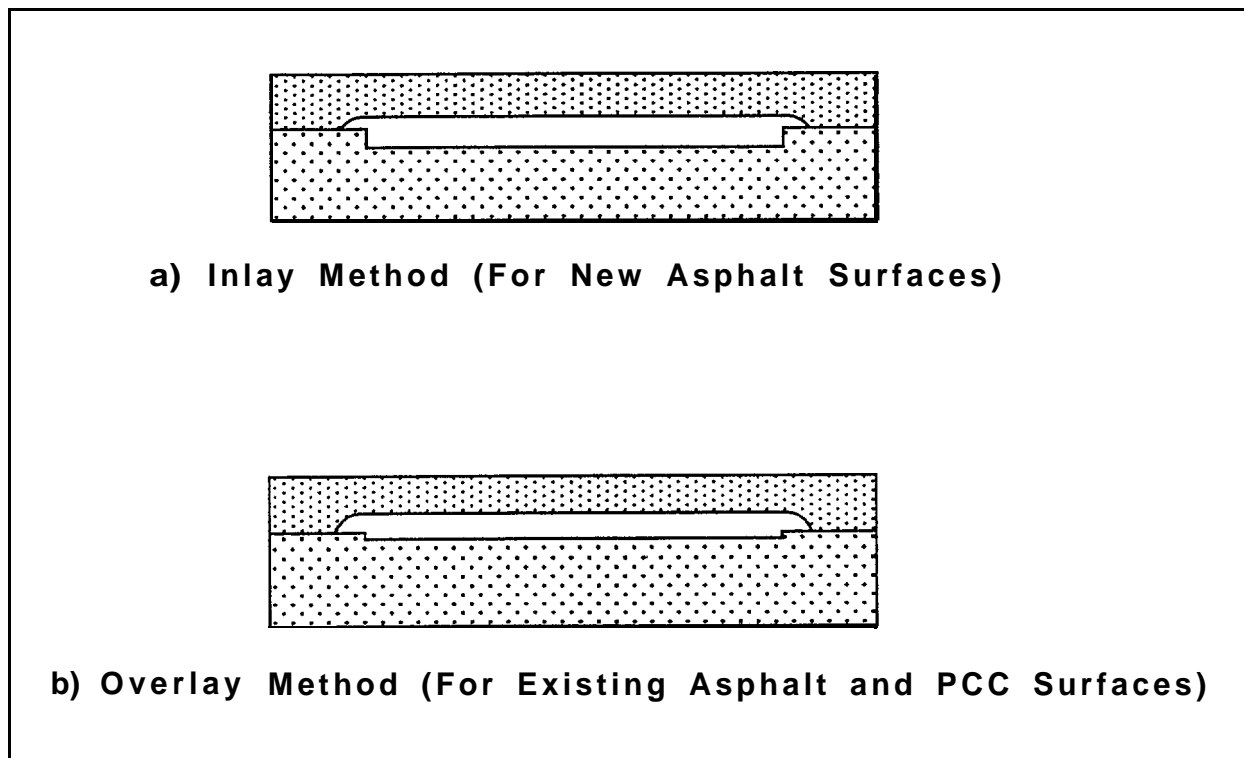


Figure 36. Basic methods of installing preformed tapes

Inlay Method

The inlay method is used in new construction or resurfacing of hot-melt asphalt concrete (HMAC) surfaces. The pressure-sensitive, self-bonding tape is positioned in place and is rolled firmly into the asphalt during the final compaction while the asphalt is still warm (at least 130 degrees Fahrenheit/54 degrees Celsius). This operation is normally performed using a paving roller.⁽⁶⁰⁾

For longitudinal markings, a tape applicator device follows the breakdown rollers and automatically lays skip lines, double yellow lines, and solid white edge lines. It can be powered with a 12-volt truck battery and is equipped with a compressed air cutoff mechanism. The tape as positioned is securely bonded to the pavement by the finish roller that follows. Precut shapes and letters must be positioned manually before compaction. The roller tends to bevel the plastic strip into the pavement.

This enhances the bond and seals out moisture.

Overlay Method

Overlaying refers to any method of installing preformed tapes on existing pavements by applying them to the surface and then creating some kind of bond with the pavement.

Permanent

Pressure-sensitive films work well for relatively new AC surfaces that are to receive permanent installations of overlaid preformed tape. When overlaying permanent preformed tapes onto old AC surfaces or PCC, better bond is achieved when contact cement is applied prior to installation. In this case, manufacturers may recommend two coats on the pavement and one on the film. This is true also for intersection markings with heavy turning movements. The markings are positioned initially by simply stepping on them and

creating slight adhesion to the pavement. A light hand-roller (or vehicle tire) is used then to partially bond the tape to the pavement to prevent movement until the continuous tire pressure of traffic ensures a secure bond.

Temporary

For construction or maintenance jobs that require the temporary delineation of new or altered travel lanes through the work zone, a thinner, self-adhesive tape can be applied directly on the pavement. Two forms of temporary marking tape are available. One form is intended for use in those construction projects where marking removal will not be required. The other form is designed for easy removability. Major advantages of the latter material include its high retroreflectivity. It can be installed quickly by a two-person crew. It can also be removed easily when the construction project is completed and traffic flow must revert to the original configuration.

The self-adhesive tape specified for temporary markings in construction zones can be removed with relative ease. The material can simply be dislodged and removed by hand or rolled up on the applicator, as shown in figure 37.

This type of operation will leave no lasting scar. A dim indication may be left by the residual adhesive, but this will be eradicated by traffic film in a short time.

Heat-fused

One relatively new method of overlaying preformed tapes has been marketed by Pave-Mark Corporation (Atlanta, GA). It consists of a special formulation of pliant polymer preformed tape used with a propane torch to create a pavement bond.

The installation process is simple. The markings are laid out in their proper locations and heat is applied to their top

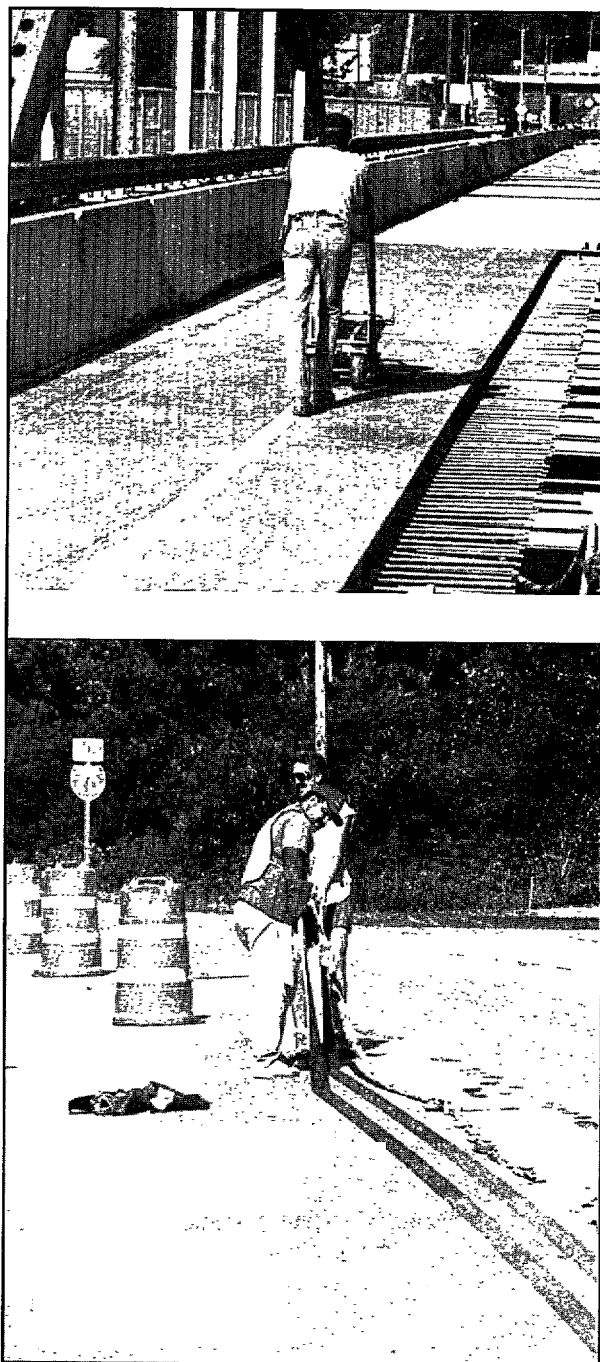


Figure 37. Installation and removal of cold-applied preformed tapes

surfaces with a propane torch. Pave-Mark claims that the material solves previous problems encountered with preformed tapes such as distortion and early loss of retroreflectivity. Research has yet to establish the validity of these claims.

Symbols

Cold-applied, preformed legends or symbols must be installed by hand, but this is a relatively simple operation. It consists of laying out the markings in their desired locations and securing them to the pavement with a roller or vehicle tire.

Removal

Removal of preformed tapes is a special problem because removal varies widely with the type of material and, more importantly, the installation method. Therefore, removal of permanent and temporary tapes is discussed separately. Also, table 2, in the chapter concerning traffic paints, details the effectiveness of various methods of removing preformed tapes.

Permanent

Removal of permanent preformed tapes can be difficult. If a good bond was achieved upon application, few methods to remove the material are effective, particularly if the material has been in place a long time.

The NYSDOT found that the best method of removing tapes was by excess oxygen burning. The heating of the material breaks its adhesive bond to the pavement. A scraping mechanism is normally used in conjunction with this method. This is similar to a method used in the past whereby the material was simply heated and the markings manually scraped from the pavement.

Temporary

Because temporary tapes do not have strong adhesives, they are very easy to remove. They simply are gathered up on a simple mechanical roller, or can usually be torn from the pavement by hand. There are no special factors or equipment to be considered.

INSPECTION

Permanent preformed tapes are composed of basically the same materials as hot-applied thermoplastic markings. Many of the inspection characteristics for thermoplastic are similar for preformed tapes. In fact, the stripping and peeling often associated with preformed tape installations make the percentage of material retained calculations described in chapter 5 particularly useful for cold-applied tapes.

Certain characteristics of permanent preformed tapes make other aspects of their inspection problematic. For example, preformed tapes should be checked especially closely for large-scale bonding failures with the substrate and also for distortion in heavy turning areas.

If it is necessary to use tapes for longitudinal markings on nonilluminated highways, they must be inspected regularly for adequate retroreflectivity.

Temporary preformed tapes are typically not in use long enough for inspection to become a major concern. Any program to inspect and identify sections of temporary preformed tape could not be implemented quickly enough to provide any benefit before the installation's lifetime has expired.